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LABORATÓRIOS E CENTROS DE INVESTIGAÇÃO À DISPOSIÇÃO DO SECTOR DA CONSTRUÇÃO

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R.U.-I.S. REABILITAÇÃO URBANA INTELIGENTE E SUSTENTÁVEL

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WHO ARE WE?

RISCO research unit

23 Integrated members
(and >30 collaborators)

SCOPE & STRATEGY

Risk assessment & mitigation measures in the built environment

Built heritage conservation and renovation

Sustainability & resources efficiency in construction

HORIZON

Grow through collaboration with different stakeholders

Contributing to several **current & future challenges**

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INFRASTRUCTURE

@ DeCivil UA
@University of Aveiro (PT)

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TROUBLES

"Art, Science and Innovation in times of Trouble"

Natural risks *(Fire, Earthquakes, Floods, Coastal erosion, …)*
Anthropogenic hazards *(Pandemics, Wars, Pollution, …)*

Heritage loss, Vandalism, Lack of conservation,
Ageing & Degradation, Pollution, …

Resources scarcity *(Water, Energy, Secondary Raw Materials)*
Indoor air quality, lack of affordable housing, durability and energy efficiency, …

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RISCO

Troubleshooting to promote **sustainable & resilient cities** through safe, environmentally-friendly, efficient and durable constructions.

- Development & application of new technologies
- Structural integrity & risk assessment
- Preservation of traditional solutions & heritage protection
- Smart & eco-efficient construction materials and systems
- Urban infrastructure & management (territorial scale)
- Well-being & environmental protection
- Energy & water efficiency
- Smart transport & energy efficient and sustainable mobility

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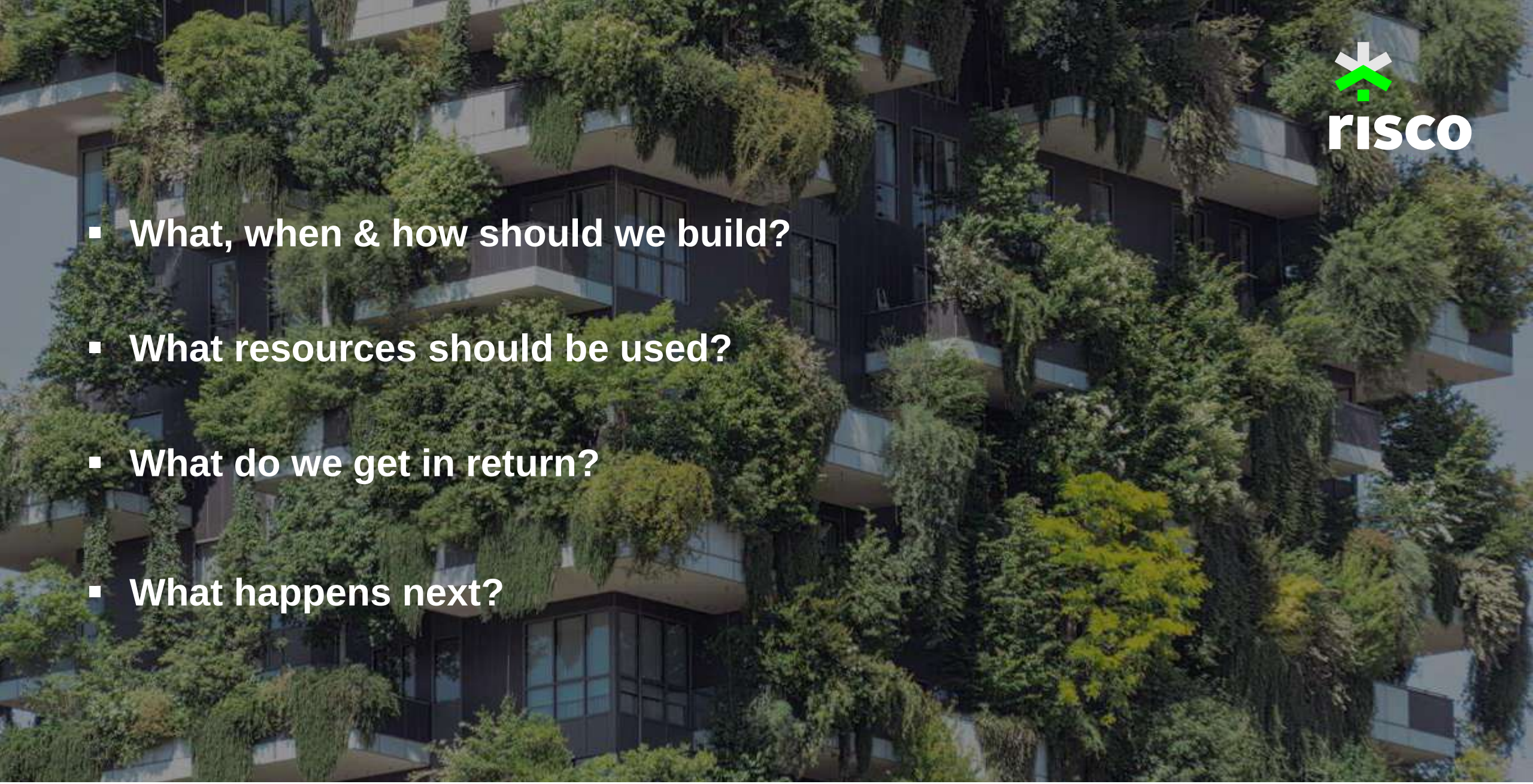

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- What, when & how should we build?
- What resources should be used?
- What do we get in return?
- What happens next?

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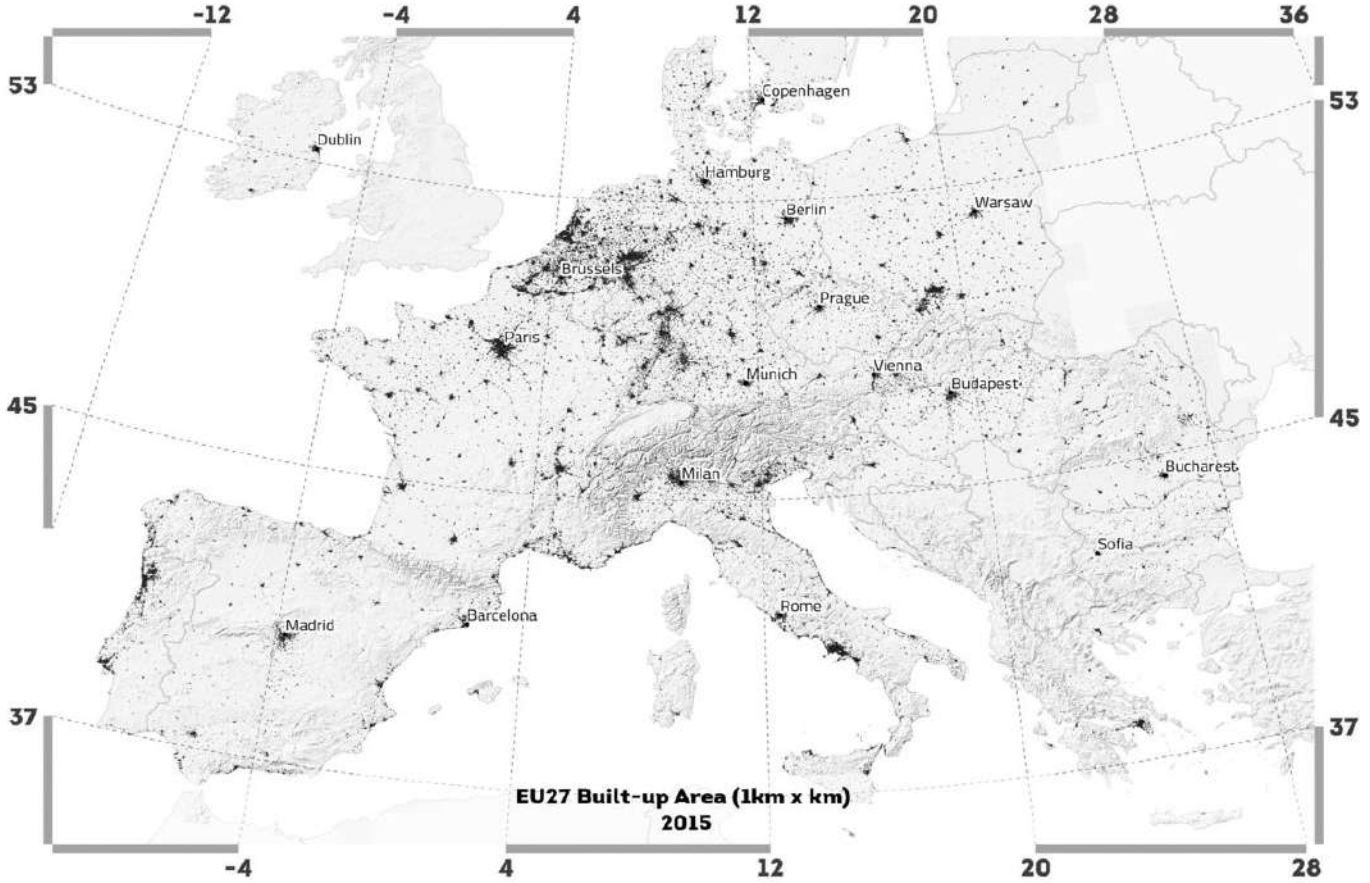
How will Europe look in 2050 – the evolution of the building stock?

V. Silva

The building stock and infrastructure in Europe is expected to increase over 30% in the next 3 decades. Will this expansion make Europe more resilient? Or will losses due to natural hazards increase?

MAIN OBJECTIVES:

- **Predict how the built environment is expected to evolve in urban and rural areas.**
- **Develop earthquake and flood scenarios considering the current and future European building stock.**
- **Explore risk mitigation actions that can alter the trajectory of disaster risk in the upcoming decades.**



Calderon A, Silva V. Exposure Forecasting for Seismic Risk Estimation. Earthquake Spectra.

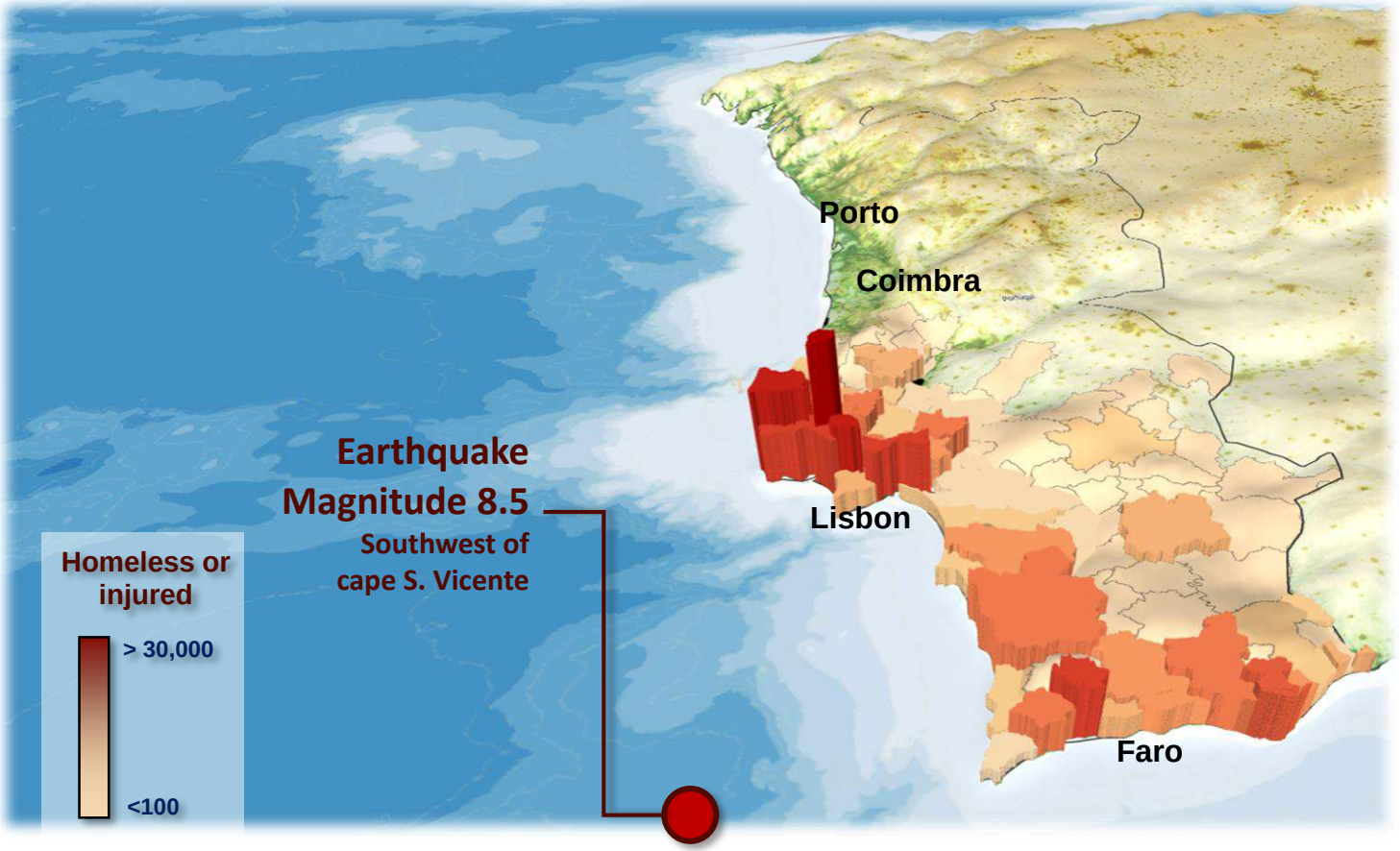
What if a Disaster occurs?

V. Silva

Its fundamental to prepare for scenarios related to the occurrence of disasters like earthquakes or floods to bring a stable emergency response.

MAIN OBJECTIVES:

- **Estimate the impact of earthquakes, floods and hurricanes in the population in terms of injuries and deaths.**
- **Evaluate the expected increase in the number of cases and associated fatalities.**
- **Estimate the impact in the healthcare infrastructure and supporting services.**



Silva V,, Paul N (2020). Potential Impact of Earthquakes during the 2020 COVID-19 Pandemic. Earthquake Spectra.

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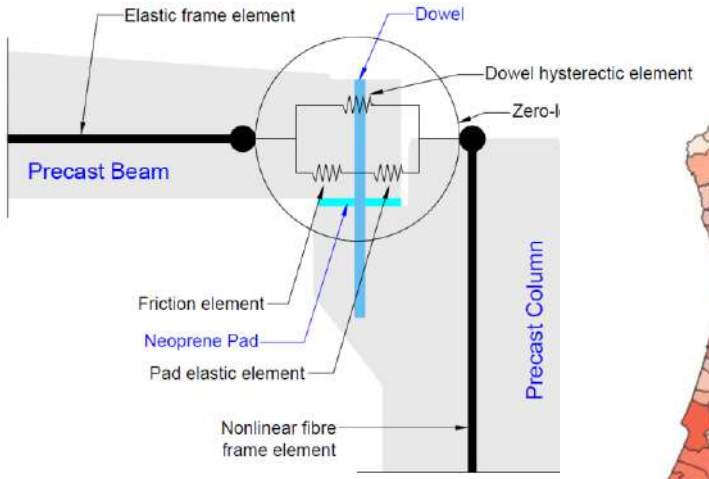
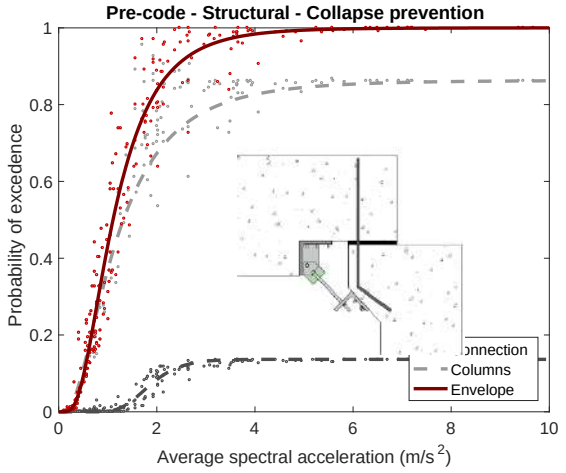
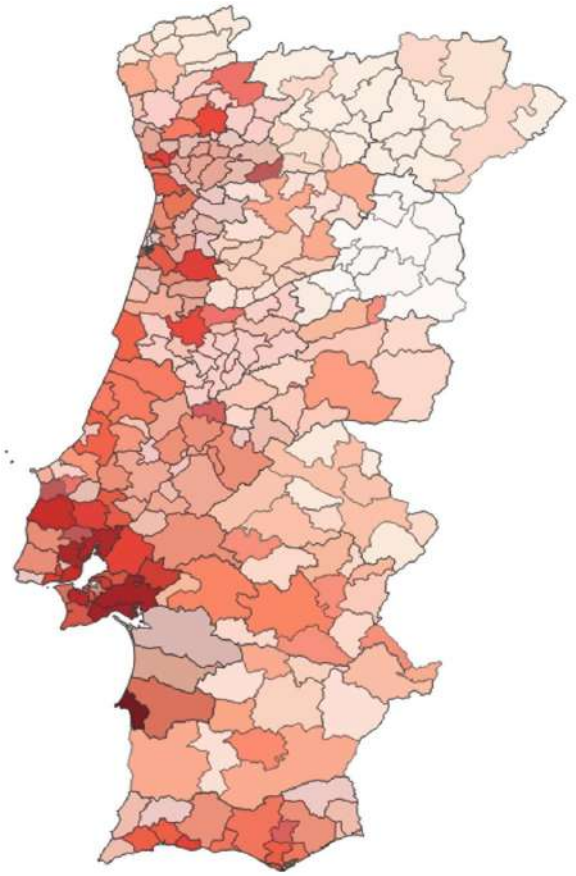
Seismic Risk in Industrial Facilities

H. Rodrigues, L. Ostetto, F. Rodrigues, A. Costa, V. Silva

Damage in industrial buildings is responsible for social and economic consequences with repercussions that can go beyond local or regional level. Recent earthquakes in the Mediterranean region caused losses estimated in several billion EUR linked to direct and indirect losses.







MAIN OBJECTIVES:

- **Develop advanced modelling tools to accurately represent the behavior of structural and non-structural components.**
- **Assess the expected seismic performance of existing RC precast structures**
- **Estimate the socio-economical impact associated with seismic induced direct and indirect losses in the industrial park.**
- **Propose sustainable retrofitting solutions to overcome the fragilities identified in typical buildings**

Project: SeismicPRECAST – Seismic Performance Assessment of Existing Precast Industrial Buildings and Development of Innovative Retrofitting Sustainable Solutions

Structural safety of stainless and tapered steel structures under fire action

É. Maia; N. Lopes; P. Vila Real; F. Arrais; C. Couto

MAIN OBJECTIVES:

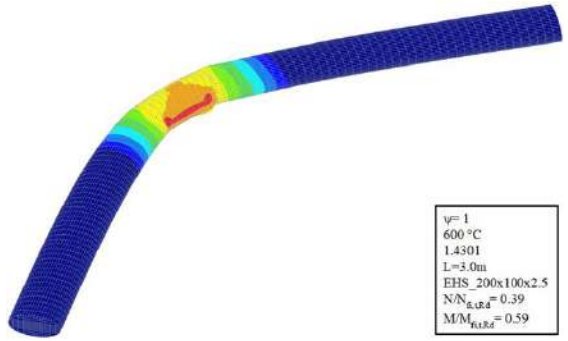
- **Experimental and numerical studies in structural members (columns, beams and beam-columns) with I or hollow cross-sections**

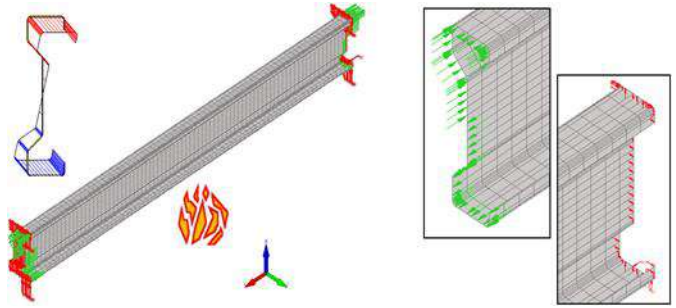
- **Development of more comprehensive, safer and economic simple calculation models for designing stainless steel structural members when exposed to fire.**

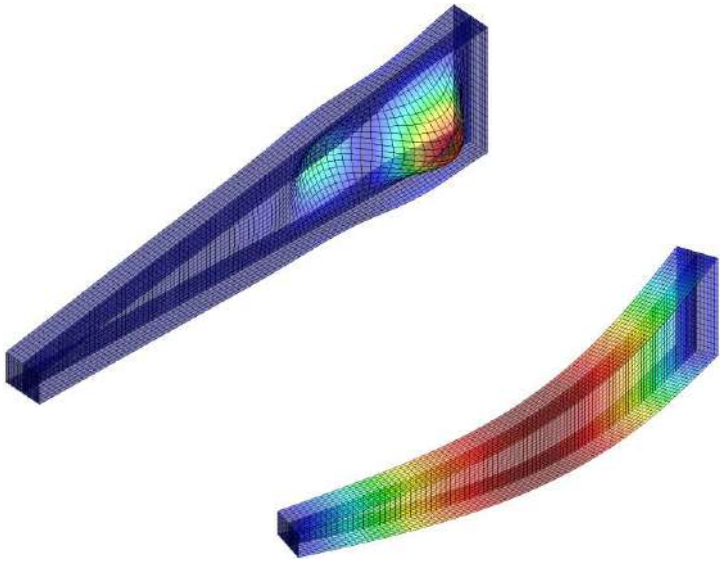
- **Adaptation of the General Method to fire**
- **Assessment of the ultimate capacity of tapered columns using GMNI-Analyses with SAFIR**

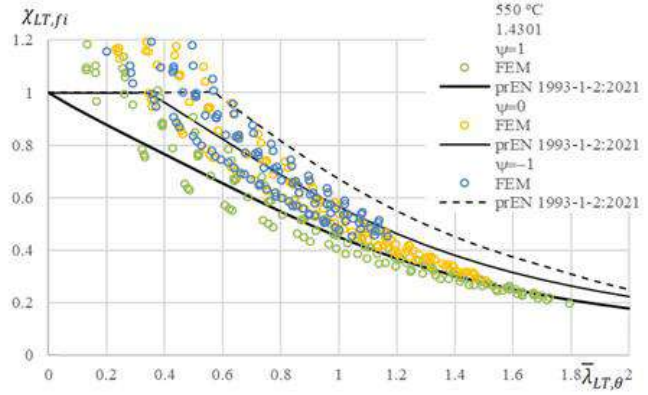
- **Calibration of the EN 1993-1-2 buckling curve**

- **Validation of the GM for the fire design of tapered columns.**





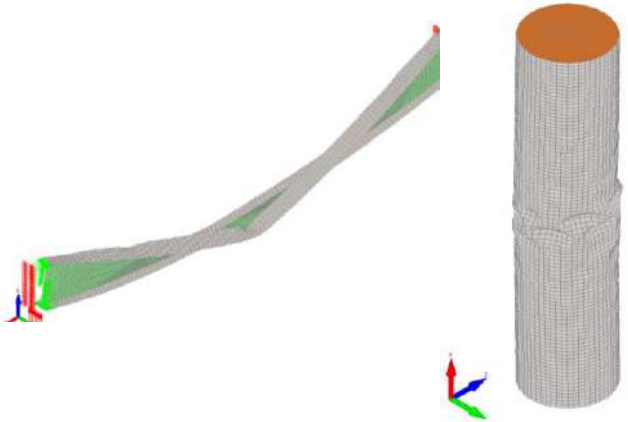


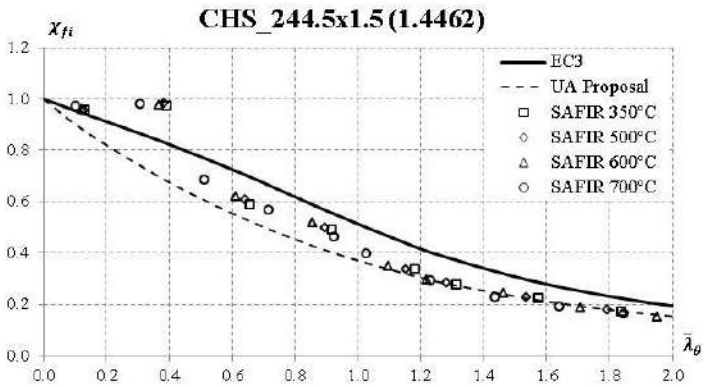


Maia, É., Vila Real, P., Lopes, N., & Couto, C. The General Method for the fire design of slender I-section web-tapered columns. Thin-Walled Structures, 155(2020)

Fire design of stainless steel members: Application to offshore structures

N. Lopes; P. Vila Real; F. Arrais





Offshore structures (such as oil rigs) are subjected to marine environment conditions with salt, sand and water, that are too severe for regular steel. Stainless steel high corrosion resistance is an advantage on offshore applications.

MAIN OBJECTIVES:

- **StaSteFi project main objective of improving the knowledge on fire resistance of stainless steel structures and contribute to a better and more optimize use of steel on offshore structures.**

Project: StaSteFi - Fire design of stainless steel members, POCI-01-0145-FEDER-030655, University of Aveiro (UA) and Instituto Superior Técnico (IST-ID)

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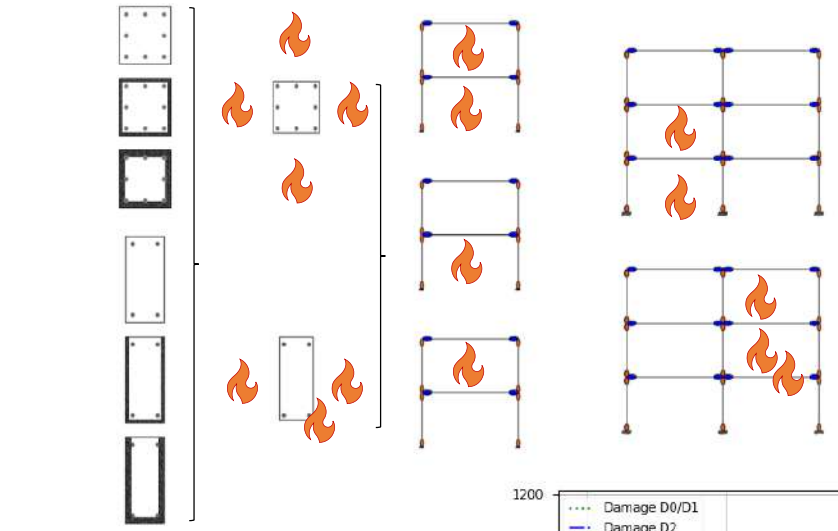
Fire Following Earthquakes

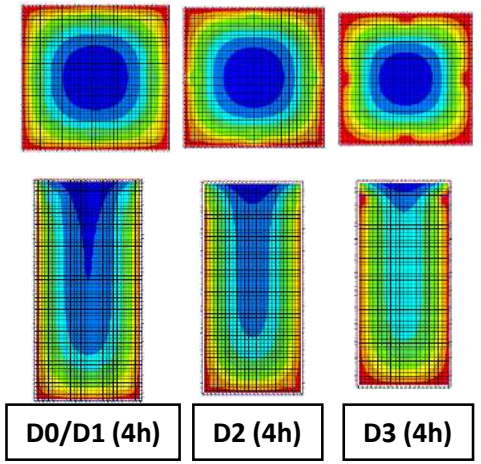
H. Vitorino, P. Vila Real, H. Rodrigues, C. Couto

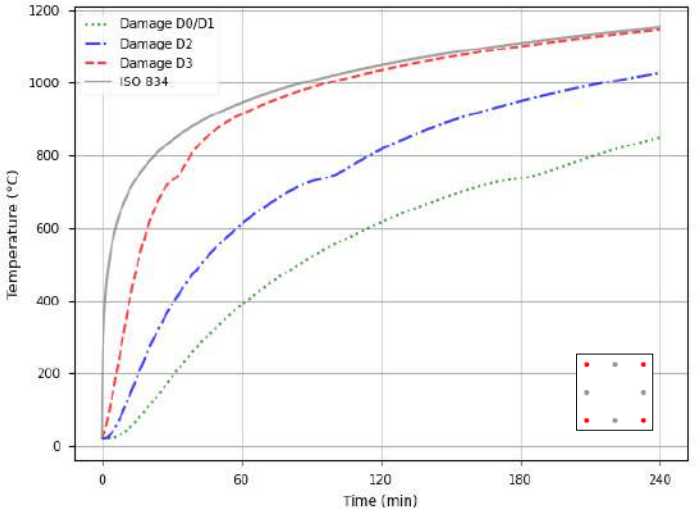
Fire following Earthquakes are events with high consequences that may cause extensive damage. However, their nature has not been fully investigated as they are low-frequency events. Most standards ignore the possibility of Fire following Earthquakes and buildings are not adequately designed for that possibility. The development of numerical studies will allow a better understanding of this phenomenon in high importance class reinforced concrete (RC) structures

MAIN OBJECTIVES:

- **Identify the best numerical analysis procedure to analyze the Fire Following Earthquake phenomenon in RC structures**
- **Real case analysis of high importance class buildings**
- **Development of guidelines and recommendations for the structural assessment of high importance class buildings to Fire Following Earthquakes**







Vitorino, H., Rodrigues, H., & Couto, C. Evaluation of post-earthquake fire capacity of reinforced concrete elements. Soil Dynamics and Earthquake Engineering, 128

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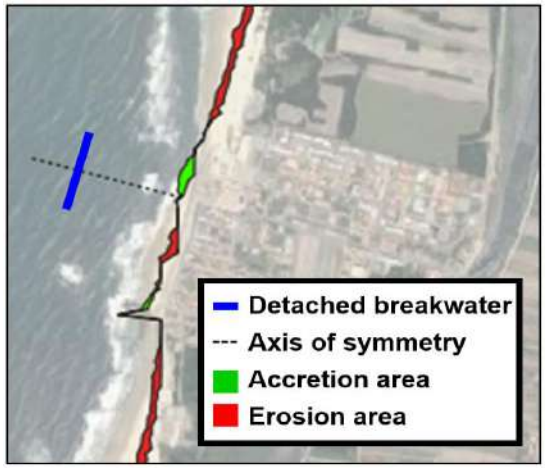
Coastal Erosion: what's the best intervention option?

C. Coelho, M. Ferreira, R. Pombo, M. Lima, P. Narra

Aveiro's beaches are characterized as a sandy coastal system with high deficit of sediment supply, being under an energetic wave climate. Coastal erosion and the retreat of the shoreline position induces more frequent overtopping events and increasing flooding risk. Choose the best intervention option depends on the specific characteristics of each site, challenging decision-makers.

MAIN OBJECTIVES:

- **Assess the performance of a set of submerged detached breakwater configurations through numerical modelling**
- **Assess different sedimentary transposition solutions at the tidal inlets**
- **Develop medium-term numerical model projections of shoreline evolution for each specific location and to perform a cost-benefit analysis of the best set of evaluated scenarios.**



Characterization and Feasibility Study of a Multifunctional Detached Breakwater in front of Vagueira Beach, POSEUR-02-1809-FC-000039

Geosynthetics for coastal protection: Design and long-term performance

F. Galvão; C. Coelho

MAIN OBJECTIVES:

- **Fill knowledge gaps and contribute with new design methods of coastal defense structures, mainly based on the case study scenarios identified along the Portuguese coast**
- **Evaluate parameters of efficiency and durability of geotextile structures**
- **Develop new and more efficient construction solutions**

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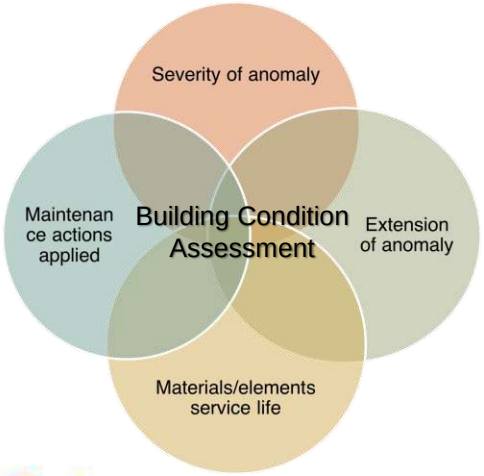
Troubleshooting by building maintenance in times of crisis

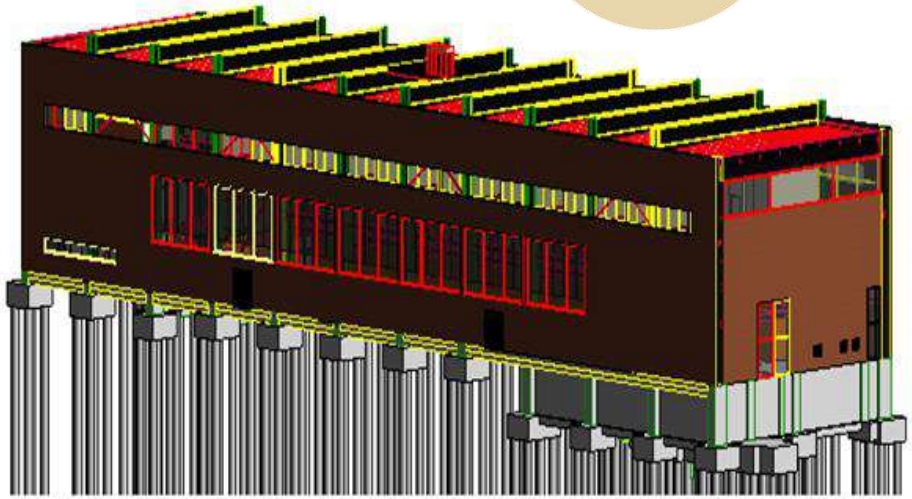
F. Vidal; R. Vicente; A. Bastos; J.A.R. Mendes da Silva

The construction sector is facing continuing difficulties with defects that are avoidable with the design for sustainable maintenance considerations. Construction sector is among the most responsible for negative impacts on the environment, being also key for minimizing the climate changes. This work promotes the proper working of the facilities, decreases the environmental impacts, and allows fast building adaptation to trouble times, using affordable, reusable and sustainable materials to respond to services demands.



MAIN OBJECTIVES:

- **Develop a Building Condition Assessment methodology supported by quantitative tools to prioritize maintenance and rehabilitation actions.**
- **Predict the optimum point and moment of a component/solution refurbishment.**
- **Integrate Life Cycle Assessment to Facility Management.**
- **Develop a BIM-based platform for easy monitorization with reliable management actions support by KPIs and LCA.**

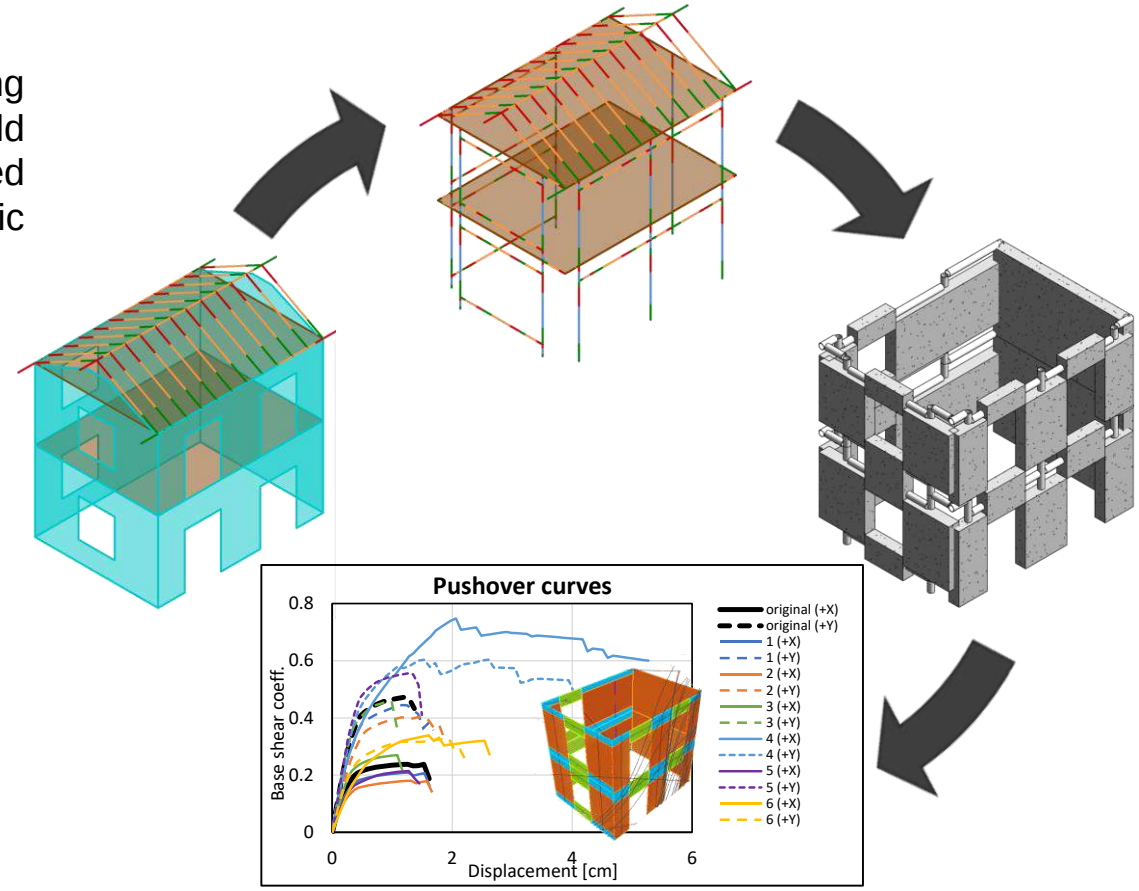


Matos, R., Rodrigues, F., Rodrigues, H., Costa, A. (2021) "Building Condition Assessment supported by Building Information Modelling" Journal of Building Engineering PhD
Grant funded by the Portuguese Government through the FCT (Foundation for Science and Technology) and European Social Fund : SFRH/BD/147532/2019

BIM-based methodology for the seismic assessment of mixed buildings

G. Lopes; R. Vicente

The use of reinforced concrete (RC) in retrofitting interventions on existing unreinforced masonry (URM) buildings has been spreading all over the world since the beginning of the twentieth century. However, many of these mixed URM–RC buildings have revealed to be particularly vulnerable to seismic action, and their inherent complex structural behaviour is still understudied.



MAIN OBJECTIVES:

- **Investigate the suitability of the use of RC in the seismic strengthening of old URM buildings**
- **Assess the vulnerability of current mixed URM-RC buildings to earthquakes**
- **Develop an efficient and automatised BIM-based methodology for the seismic assessment of mixed buildings**

G. Correia Lopes, N. Mendes, R. Vicente, T.M. Ferreira, M. Azenha, Numerical simulations of derived URM-RC buildings: Assessment of strengthening interventions with RC.
PhD Grant funded by the Portuguese Government through the FCT (Foundation for Science and Technology) and European Social Fund: PD/BD/135201/2017.

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BUILT HERITAGE

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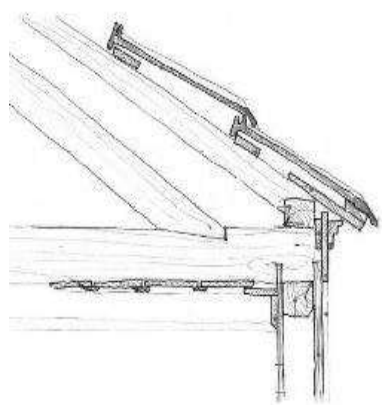
Conservation of traditional construction buildings near the seaside

H. Portela, A. Velosa, V. M. Ferreira

Conservation of typical traditional buildings in the Aveiro seaside region - the haylofts (palheiros). Haylofts suffer high degradation from maritime influence and have been submitted to multiple transformations often resulting in its mischaracterization.

MAIN OBJECTIVES:

- **Examine how sustainability criteria may determine the type of conservation to preserve this type of traditional seaside construction.**



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Why safeguarding glazed tile façades?

A. Velosa

To safeguard, recover and assuring the built heritage constituted by our unique Portuguese glazed tile facades (Azulejo) preserving an attractiveness and cultural elements in our cities.

MAIN OBJECTIVES:

Based on several conservation measures in buildings and respective cities to model and promote:

- **Materials – conservation**
- **System compatibility**
- **Degradation mapping**
- **Intervention techniques and principles, inducing changes in Portuguese legislation**

Project: AZULEJAR, SOS AZULEJO GROUP, DB-HERITAGE PROJECT

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Efficient, comfortable, healthy and sustainable affordable housing

A. Costa, A. Tavares, J. Fonseca, A.D. Alves, F. Rodrigues

According to the Renovation Wave for Europe, building stock is both unique and heterogeneous in its expression of the cultural diversity and history. It is also old and changes very slowly. More than 220 billion building units, representing 85% of the EU's building stock, were built before 2000. 85-95% of the buildings that exist today will still be standing in 2050.
To move moving towards a low-carbon economy, historic buildings retrofit can be a balance between traditional, sustainable solutions and high energy performance, giving to low-income families healthy and affordable housing

MAIN OBJECTIVES:

Promote built heritage retrofit based on sustainable and traditional construction technics:

- **Eco-refurbishment of the heritage housing at historic centers**
- **Eco-retrofit of heritage buildings**
- **Systemic transformation of the rehabilitation of built heritage that allows articulating the energy transition towards a low-carbon economy model**

Project: ENERPAT Les techniques d'éco rénovation du bâti ancient. (Interreg Sudoe)

Measurement of atmospheric corrosion on metal and stone in coastal locations

F. Vidal; R. Vicente; A. Bastos; J.A.R. Mendes da Silva

Corrosion and soiling is demands for building intervention, cause aesthetic nuisance, and increase the need for regular maintenance. Combined atmospheric corrosion leads to the corrosion of metals and stone recession.

MAIN OBJECTIVES:

- **Understand the influence of pollution impact over traditional building materials. Compare corrosivity and soling results between urban areas and a near-coastal location.**
- **Validation of dose-response functions and suggest changes.**
- **Calculation of estimated costs of damage – maintenance strategy.**

Metal	Programme	Dose-response function
Carbon steel	ISO 9223	$R = 1.77P_d^{0.52}\cdot\exp(0.020RH + f_{St}) + 0.102S_d^{0.62}\cdot exp(0.033RH + 0.040T)$ $f_{St} = 0.150\cdot(T - 10)$ when $T \leq 10$ºC, $-0.054\cdot(T - 10)$ otherwise
	MICAT	$R = 16.042 - 0.276T - 0.256RH + 6.243TOW + 0.007P + 1.521P_d + 0.962S_d$
Copper	ISO 9223	$R = 0.0053\ P_d^{0.26}\cdot\exp(0.059RH + f_{Cu}) + 0.01025S_d^{0.27}\cdot\exp(0.036RH + 0.049T)$ $f_{Cu} = 0.126\cdot(T - 10)$ when $T \leq 10$ºC, $-0.080\cdot(T - 10)$ otherwise
	MICAT	$R = -1.891 + 0.063T + 0.019RH + 1.26TOW - 0.281\cdot10^{-3}P + 0.017P_d + 0.012S_d$
Zinc	ISO 9223	$R = 0.0129P_d^{0.44}\cdot\exp(0.046RH + f_{Zn}) + 0.0175S_d^{057}\cdot\exp(0.008RH + 0.085T)$ $f_{Zn} = 0.038\cdot(T - 10)$ when $T \leq 10$ºC, $-0.071\cdot(T - 10)$ otherwise
	MICAT	$R = -1.798 + 0.044T + 0.014RH + 0.974TOW + 0.527\cdot10^{-3}P + 0.003P_d + 0.02S_d$
Aluminium	ISO 9223	$R = 0.0042P_d^{0.73}\cdot\exp(0.025RH + f_{Al}) + 0.0018S_d^{0.60}\cdot\exp(0.020RH + 0.094T)$ $f_{Al} = 0.009\cdot(T - 10)$ when $T \leq 10$ºC, $-0.043\cdot(T - 10)$ otherwise
	MICAT	$R = -0.783 + 0.035T + 0.004RH + 0.915TOW - 0.394\cdot10^{-3}P + 0.022P_d + 0.007S_d$

Where:

R	=	Annual corrosion rate (µm/a)	P	=	Amount of precipitation (mm)
T	=	Annual average temperature (ºC)	P_d	=	Annual average SO_2 deposition (mg/m².d)
RH	=	Annual average relative humidity (%)	S_d	=	Annual average Cl^- deposition (mg/m².d)
TOW	=	Time of wetness (h/a)			

Dose-response functions developed to estimate annual corrosion rates

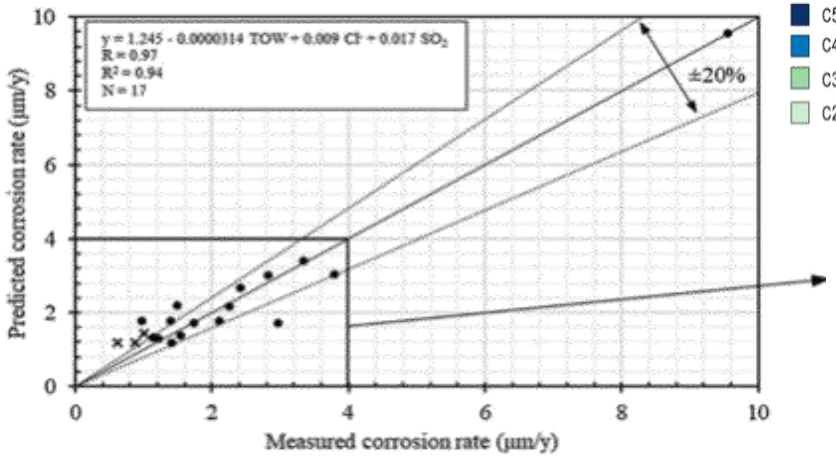
Project: TRAPHIC – Traffic related air pollution impacts on historic city centres: an integrated approach

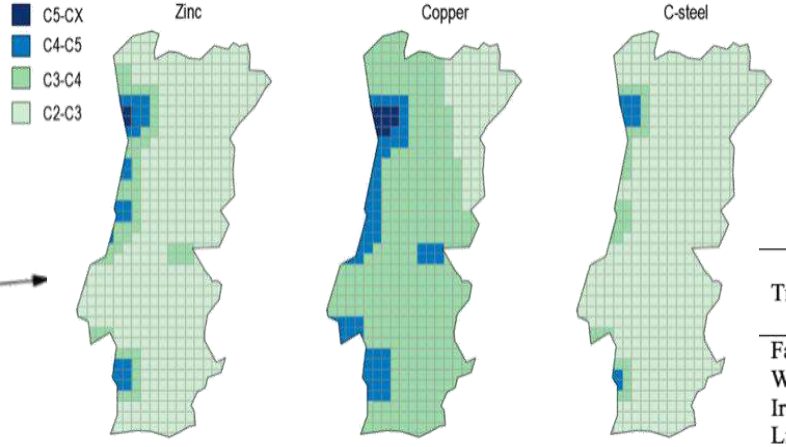
Environmental and air pollution impacts on coastal built heritage

F. Rodrigues, H. Rodrigues, R. Matos, A. Costa

MAIN OBJECTIVES:

- **Redefinition of dose-response functions through multi-regression analysis**
- **Remapping corrosion in near-coastal areas**
- **Prediction of maintenance periods and costs**





$$K_{total} = \sum_{i=1}^{n} K_i = \sum_{i=1}^{n} \frac{k_i \cdot S_i}{L_i}$$

Estimated damage costs associated to air pollution.

Treatment action	Average interval (years)	Cost (K_1) (€/year)	Cost (K_2) (€/year)	Cost (K) (€/year)	Total cost (K_{total}) (€/year)
Façade cleaning	12	232061.19	301333.19	243762.02	
Washing of limestone surfaces	12	198884.77	306500.50	240086.86	
Iron guard treatment	14	22135.94	30104.88	22563.68	541932.72
Limestone treatment	85	21595.26	21595.26	21595.26	
Substitution of zinc flashings	85	13924.91	13924.91	13924.91	

F. Vidal, R. Vicente; J.A.R Mendes Silva, Review of environmental and air pollution impacts on built heritage: 10 questions, Journal of Cultural Heritage, Vol. 37

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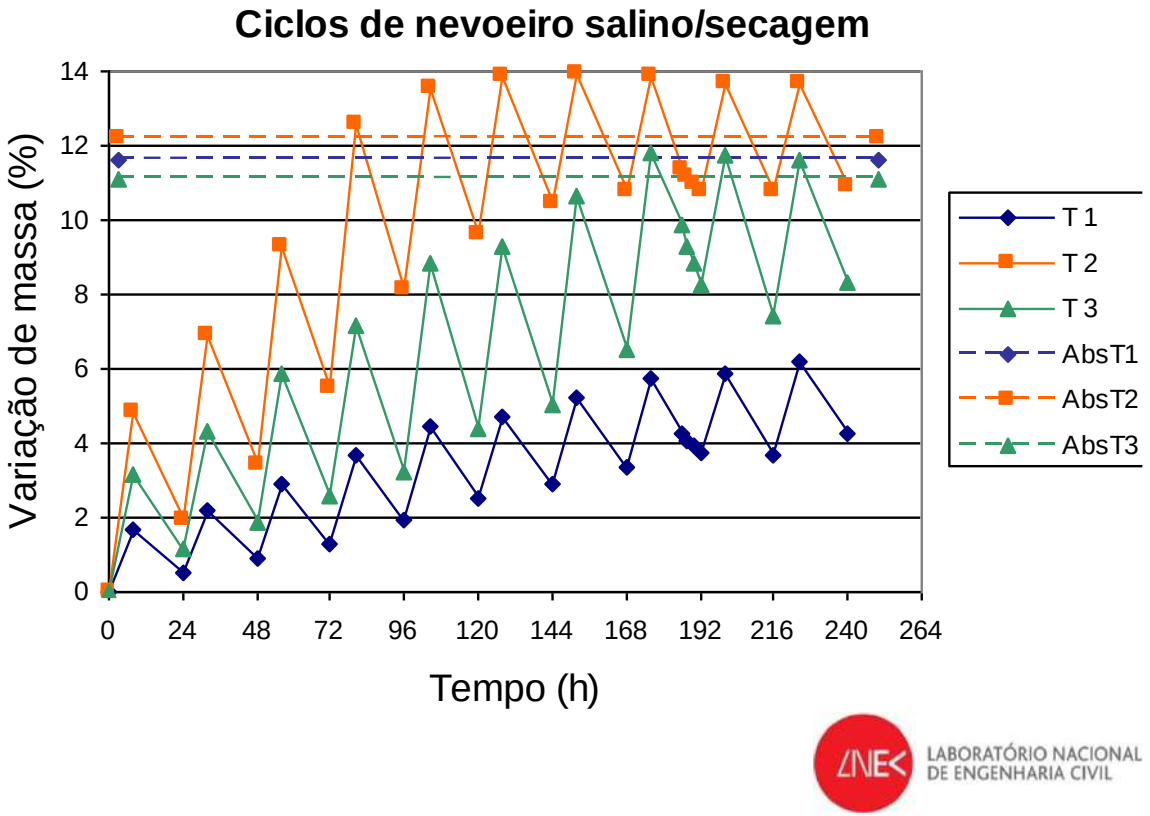
Behaviour and durability of ceramic roof tiles in a marine environment

C. Cruz, R. Veiga, V. M. Ferreira

MAIN OBJECTIVES:

- **Study of degradation mechanisms by accelerated artificial ageing tes assess durability of ceramic roof tiles in marine environments**
- **Study of degradation causes and ad-hoc solutions for salt attack**



LNEC LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

C. Cruz, Behaviour and durability of ceramic roof tiles in a marine environment, PhD thesis, [supervision: V.M. Ferreira (UA) & R. Veiga, (LNEC)]

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SUSTAINABILITY

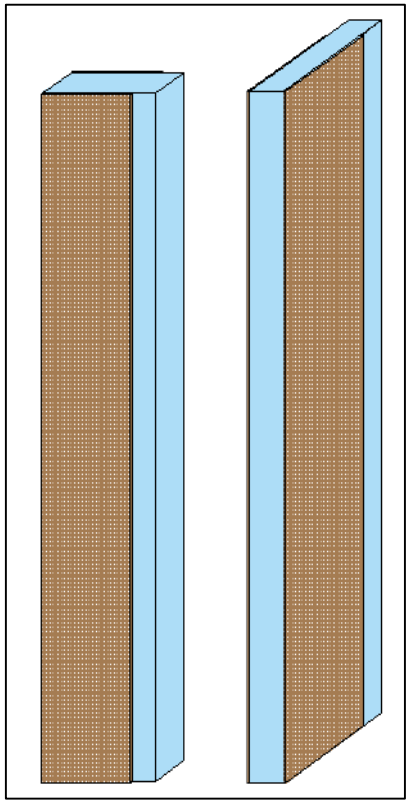
WF-NBIOT (Wall Fit – Narrowband Internet of Things): a new WC solution

M. Morais, I. Meireles, A. Velosa, S. Ferreira, A. Kalthoum

To be competitive with undeveloped countries, the European companies have been forced to innovate and to increase the added value of their products. Scientific research focusing on the challenges of modern construction concluded that WC can be more sustainable and intelligent.

MAIN OBJECTIVES:

- **Development of a prefabricated WC solution highly innovative (modular, lightweight, easy to transport and apply, competitive cost).**
- **Toilet flushing and air quality data acquisition and transmission through Narrowband and IOT.**
- **Development of a new interior partition solution.**
- **Sustainable solution (optimization of the solution through life cycle analysis).**



Technical drawing

Laboratory Prototype

Project: WF-NBIOT – Wall Fit – Narrowband Internet of Things, POCI-01-0247-FEDER-039396

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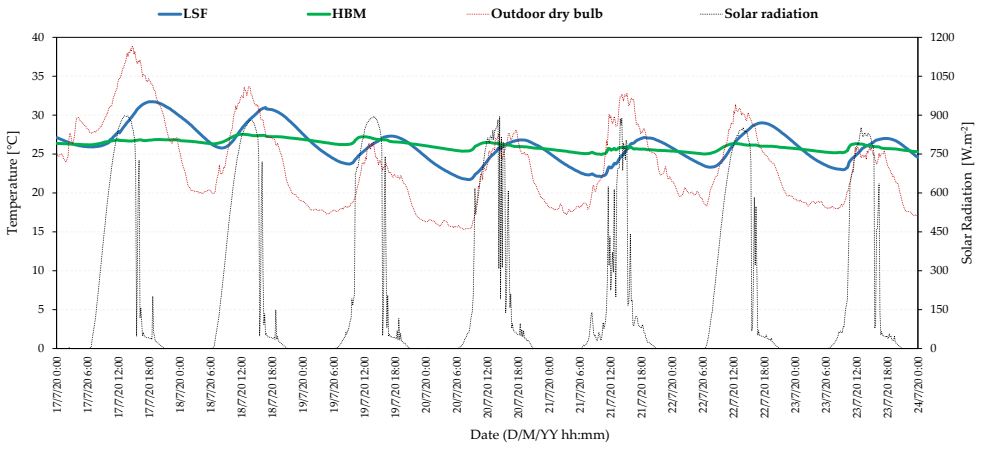
Light Steel Framing construction in the Southern European context

E. Roque, R. Vicente, V. Ferreira

Given the proliferation of the Light Steel Framing (LSF) systems, it is crucial to characterize how they perform in the southern European context, in terms of thermal comfort and energy efficiency when compared to masonry and reinforced concrete construction (HBM). Acknowledging the relevance of experimental studies, a long-term monitoring campaign was established. This campaign is founded on monitoring two identical experimental test cells, representing the two constructive systems.

MAIN OBJECTIVES:

- **Assess LSF buildings energy efficiency and indoor comfort in a southern European climate and considering a residential occupation**
- **Characterize the indoor thermal environment of LSF buildings across seasons**
- **Quantify the energy consumption required to maintain indoor thermal comfort**
- **Assess the impact of constructive configurations on the energy consumption and comfort**
- **Establish and evaluate novel constructive and operational strategies**



Project: Research Project in Partnership with Perfisa – Fábrica de Perfis Metálicos, S.A.

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Paperchain – Industrial symbiosis on paper & pulp industry wastes as alternative raw materials in construction

V. Ferreira, M. Morais, H.Paiva, H. Maljaee

This project has allowed to set up in 4 different countries of Europe (Portugal, Spain, Slovenia and Sweden) large scale demonstrators of 5 circular cases on waste valorization as alternative raw materials in construction, chemical and mining sectors. In Portugal 2 pilot cases were designed, implemented and monitored after upscaling to a real scale at industrial level.
Circularity and sustainability analysis with a life cycle approach were made in this cases and other details are available on the project website (www.paperchain.eu).

MAIN OBJECTIVES:

- **Minimize the risk of huge amounts of waste landfill disposal**
- **Sustainable solutions using PPI wastes as alternative raw materials in construction and other sectors**
- **Circular economy model studies ad validation on this industrial symbiosis actions**
- **Upscale and large-scale demonstration of these solutions.**

Project: H2020 circular economy large-scale demonstration European project (ref~730305 2017-2021) - EU partners

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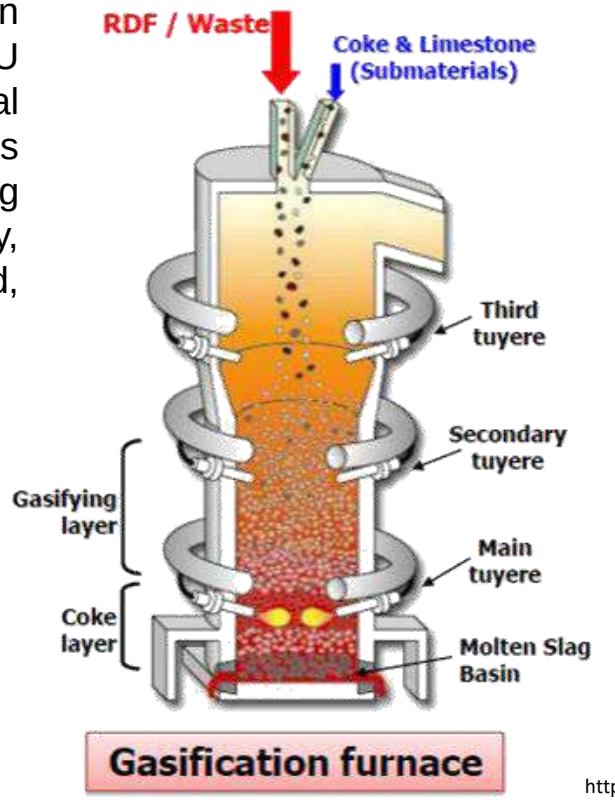
NEW MINE – Resource Recovery Through Enhanced Landfill Mining

G. Ascensão

Europe has somewhere between 150,000 and 500,000 landfill sites, with an estimated 90% of them being “non-sanitary” landfills, predating the EU Landfill Directive of 1999. These older landfills tend to be filled with municipal solid waste and often lack any environmental protection technology. This situation might appear bleak, but it does present us with an exciting opportunity for a combined resource-recovery and remediation strategy, which will drastically reduce future remediation costs, reclaim valuable land, while unlocking valuable resources. (https://new-mine.eu/).

MAIN OBJECTIVES:

- **Develop innovative landfill exploration & mechanical processing**
- **Improve solar/plasma/hybrid thermochemical conversion**
- **Develop advanced upcycling technologies**
- **Multi-criteria assessment for integrated ELFM technologies**



https://inhabitat.com/plasma-rock-is-a-new-material-made-from-100-recycled-landfill-waste/plasmarock3/

Project: EU Training Network for Resource Recovery Through Enhanced Landfill Mining

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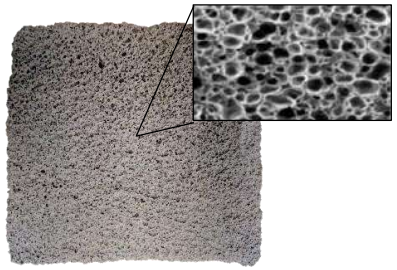
Binders & mortars

Insulating materials



Sandwich panels

MAIN OBJECTIVES:

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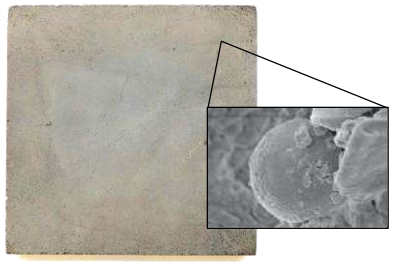
High temperature resistant materials

Thermo-reactive materials



Project: EU Training Network for Resource Recovery Through Enhanced Landfill Mining

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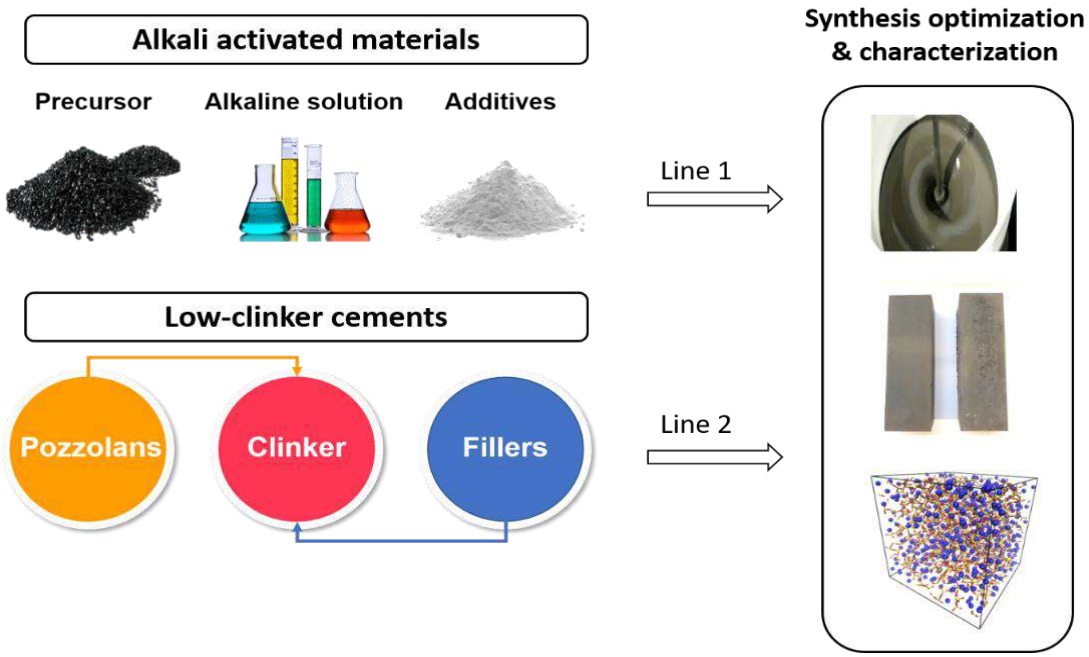
Development of advanced building materials for sustainable construction

G. Ascensão; V. Ferreira

In this project, locally available but currently underutilized industrial wastes and by-products will be identified, characterized and surveyed as potential secondary feedstock materials for the production of sustainable binders and advanced building materials made from thereof. After assessing the availability, geographic dispersion and characteristics of individual waste streams, different upcycling pathways will be explored, including low-clinker cements and activated alkaline materials.



MAIN OBJECTIVES:

- **Understand the fundamental processing parameters affecting hydraulic and alkaline binders**
- **Establish the first principles of the conceptual design for innovative building materials**
- **Analyze major problematics related to different upcycling solutions**
- **Optimization of the developed products**

Project: FCT- Portuguese Foundation for Science and Technology through the Aveiro Research Center for Risks and Sustainability in Construction, UIDP/ECI/04450/2020

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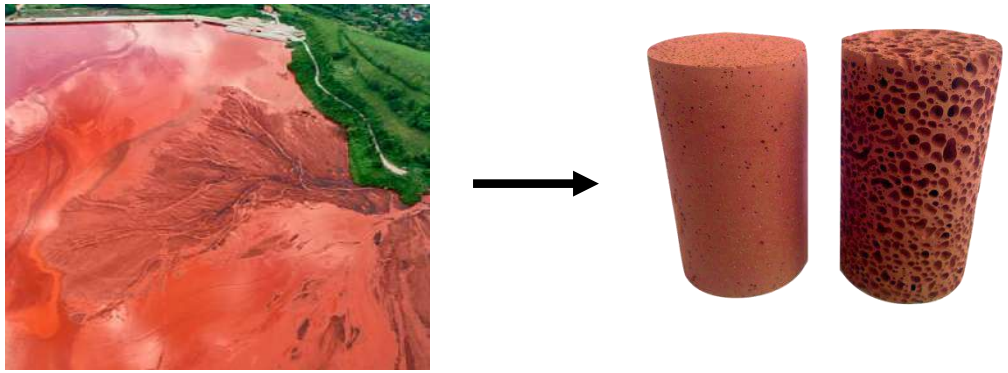
Red Mud



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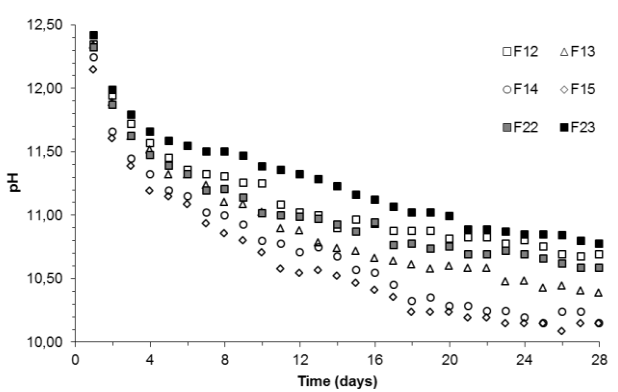

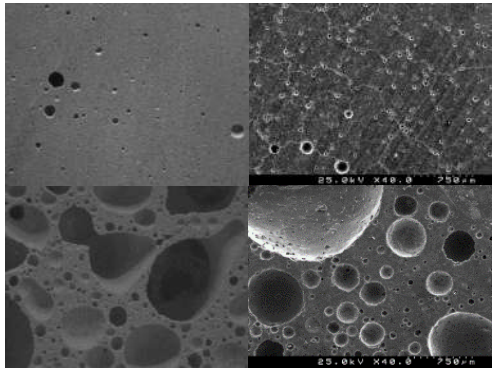

Ascensão, G., et al. Red mud-based geopolymers with tailored alkali diffusion properties and pH buffering ability. Journal of cleaner production, 148, 23-30.

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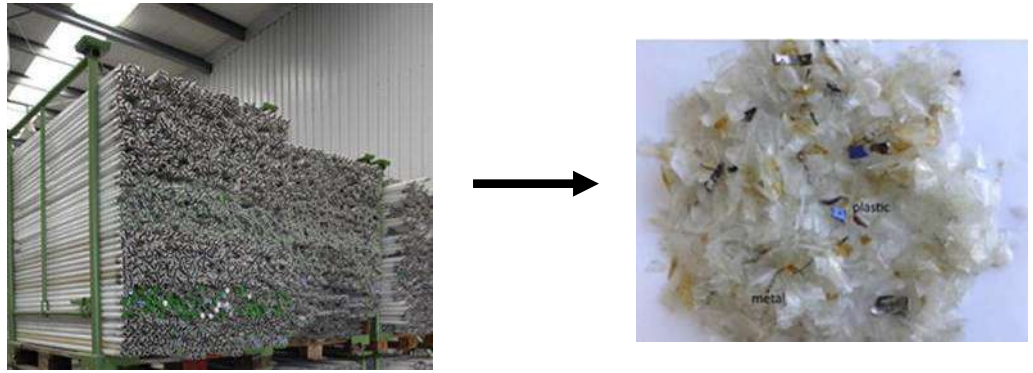
Lamps



Novais, R. M., Ascensão, G., Seabra, M. P., & Labrincha, J. A.. Waste glass from end-of-life fluorescent lamps as raw material in geopolymers. Waste management..

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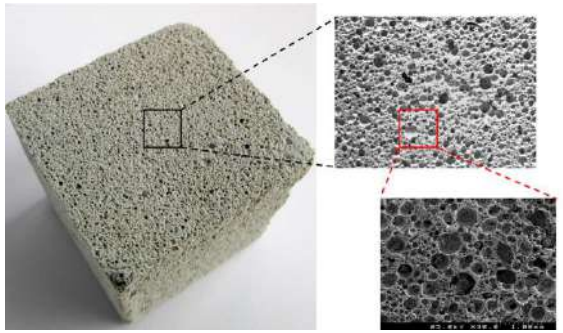
Fly Ash



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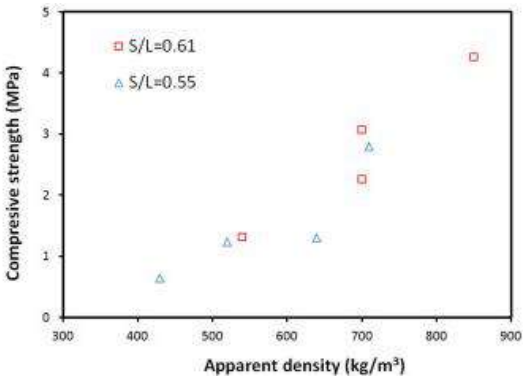

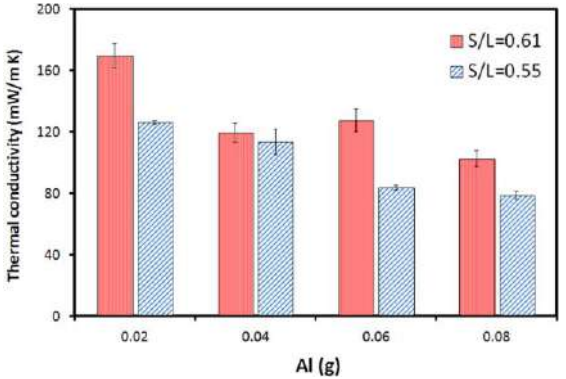

Novais, R. M., Ascensão, G., Ferreira, N., Seabra, M., & Labrincha, J. A. Influence of water and aluminium powder content on the properties of waste-containing geopolymer foams.

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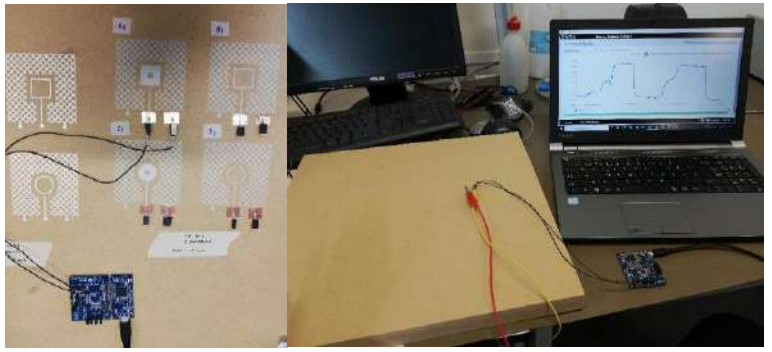
Built Environments for an Active, Safe and Healthy Life

R. Vicente, V. Ferreira

The decrease in young population together with the increase in the elderly one, the aging rate will more than double from 147 to 317 elderly people for every 100 young people in 2080. Hence, the need for decentralized healthcare and the use of the built environment (our habitat) as a space where the population tends to spend more time, plays a crucial role in fighting isolation and providing greater and better quality of life, together with more resilient cities (resilient Habitat).



Sensors (temp, vibration, etc.)

MAIN OBJECTIVES:

- **Supporting the proximity care network;**
- **Promote human functionality through physical and cognitive stimulation**
- **Interaction of the built space through its digitization**
- **Develop new materials to allow the integration of in-built sensors**
- **Develop adaptive and transformable modular structures, furniture and equipment prefabricated modular construction systems for specific human needs**

Prefabrication

Project: ActiVas -Ambientes Construídos para uma Vida Ativa, Segura e Saudável, Mobilizador IDT, POCI-01-0247-FEDER-046101, 21 partners

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Thermally enhanced mortars towards high-end efficient buildings

F. Rebelo, A. Figueiredo, R. Vicente, V. Ferreira

Incorporating Phase Change Materials (PCMs) into building applications is a promising strategy for achieving indoor thermal comfort while promoting energy efficiency. Aware of the increasing trend of lightweight construction worldwide and given the lack of thermal inertia characteristic of this constructive system, innovative thermally enhanced mortars with incorporation of PCM, for indoor coating applications, were developed and fully characterized, targeting the reduction of overheating whilst promoting indoor passive thermal regulation and energy efficiency. Real scale lightweight demonstrators were built and continuous monitoring of indoor temperatures and energy consumption is running.

MAIN OBJECTIVES:

- **Develop thermally enhanced mortars incorporating PCM**
- **Thermophysical characterization of the PCM-containing mortars**
- **Overheating reduction in lightweight buildings**
- **Laboratorial characterization and real scale demonstrators monitoring.**

Thermal conductivity characterization

Real Scale Demonstrator

Microstructure

Project: SUDOKET – Mapping, consolidation and dissemination of the Key Enabling Technologies (KETs) for the construction area in the SUDOE space [SOE2/P1/E0677], INTERREG SUDOE

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Energy poverty and dependency – smarter materials and systems

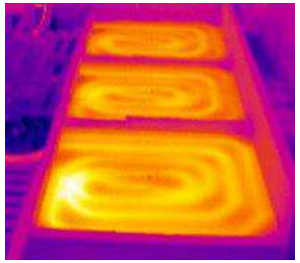
R. Vicente, V. Ferreira, G. Ascensão, H. Rodrigues, A. Figueiredo, H. Paiva

Europe is moving towards a low-carbon economy and increased awareness about environmental and energy efficiency stimulated by stringent energy efficiency standards driven by EU Energy Efficient Directive and NZEB, along with development of smart digital heating/cooling technologies. A long-term vision for the research outcomes of this project is driven to the future trend of smarter TABS (thermally activated buildings systems) that still seek to balance the role of the building fabric to regulation requirements. respond to the binomial structural-thermal

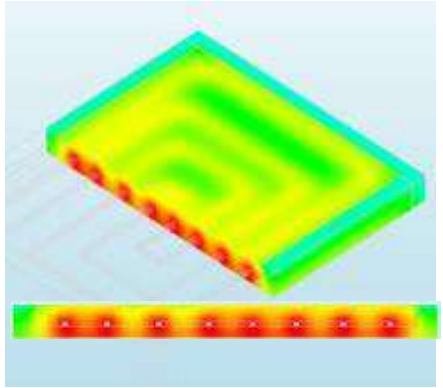
MAIN OBJECTIVES:

- **Develop new radiant floor systems for both heating and cooling**
- **Incorporating of by-products and phase change materials**
- **Incorporating blend of phase change materials, to enhance thermal energy**
- **Conduct robust experimental campaigns**
- **Optimization of operational conditions (smart sensoring, AI and predictive control.**

Sensoring



Thermal imaging



Simulation and optimization

Project: SEERFloor – Super Energy Eficient Radiant Floor Systems, POCI-01-0247-FEDER-046101, 21 partners

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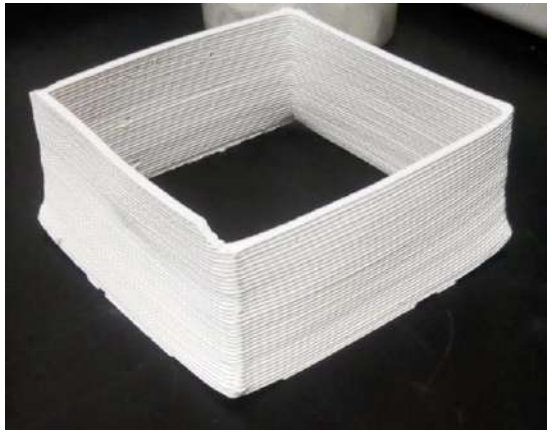
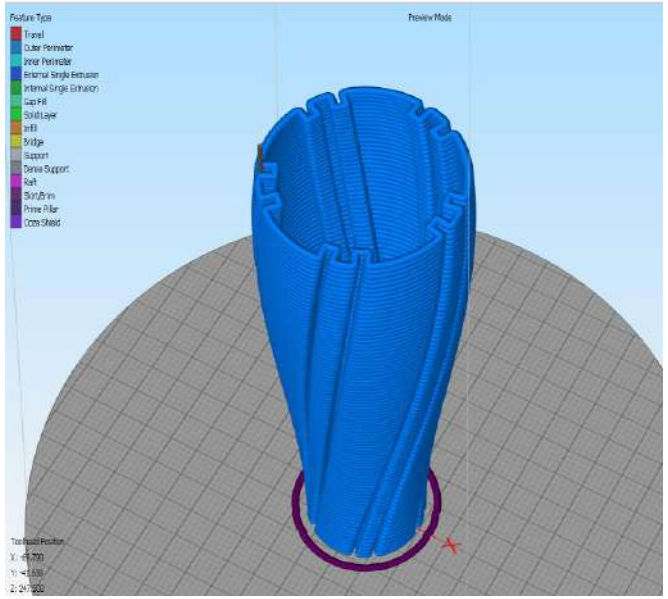
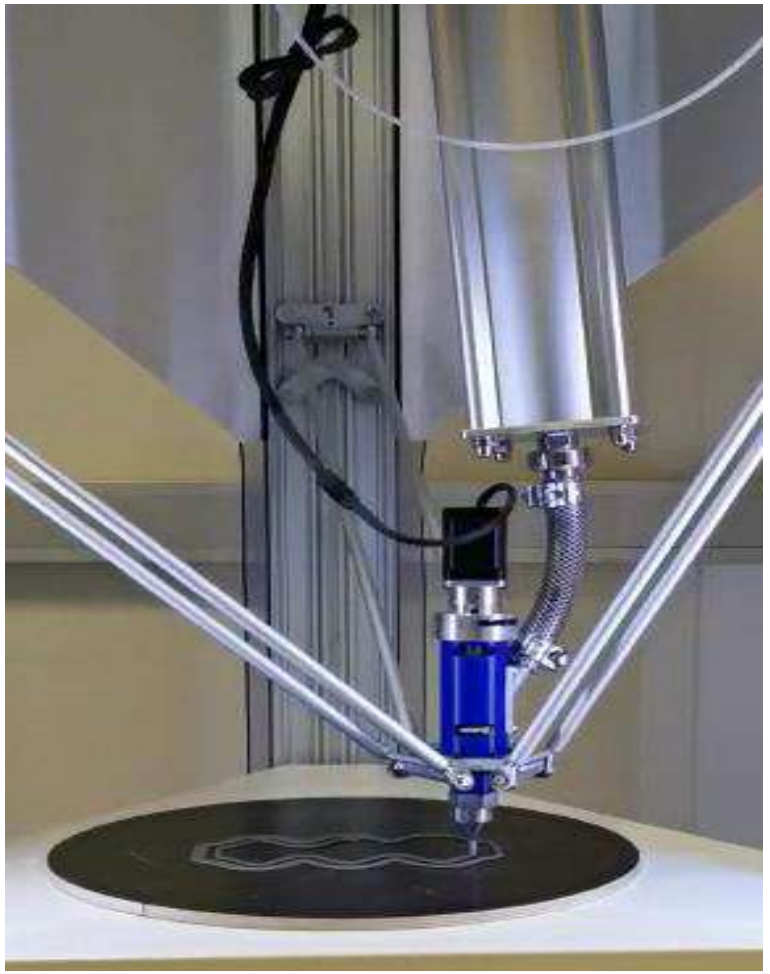
Efficient manufacturing methods

R. Vicente, V. Ferreira, G. Ascensão

Additive manufacturing





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Acknowledgments

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LABORATÓRIOS E CENTROS DE INVESTIGAÇÃO À DISPOSIÇÃO DO SECTOR DA CONSTRUÇÃO

Guilherme Ascensão
RISCO, Department of Civil Engineering University of Aveiro

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AICCOPN
Associação dos Industriais da Construção Civil e Obras Públicas

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